

Notice of Allowability

Application No.

10/727,629

Examiner

Roberta Prendergast

Applicant(s)

PARK ET AL.

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 3/1/2007.
2. ☒ The allowed claim(s) is/are 1 and 3-33.
3. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) ☒ All b) ☐ Some* c) ☐ None of the:
 1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
 5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
 - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO/SB/08),
Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit
of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☐ Interview Summary (PTO-413),
Paper No./Mail Date _____
7. ☒ Examiner's Amendment/Comment
8. ☐ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____

EXAMINER'S AMENDMENT

An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Nicole Dretar on 3/28/2007.

The application has been amended as follows:

Claim 1, line 17, replace the phrase "... bitstream..." with "...bitstream; and transmitting the encoded bitstream to a decoder."

Claim 7, line 17, replace the phrase "... is encoded..." with "...is encoded; and (f) transmitting the encoded three-dimensional object data to a decoder."

Claim 23, lines 11-14, replace the phrase "...have sub-nodes; and restoring the three-dimensional object data whose nodes are encoded to the tree structure..." with "...have sub-nodes; restoring the three-dimensional object data whose nodes are encoded to the tree structure; and displaying the decoded three-dimensional object data."

Claim 24, lines 8-11, replace the phrase "...located where objects exist and in the background do not have sub-nodes; and restoring the three-dimensional object data whose nodes are encoded to the tree structure..." with "...located where objects exist and in the background do not have sub-nodes; restoring the three-dimensional object

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data whose nodes are encoded to the tree structure; and displaying the decoded three-dimensional object data."

Claim 30, lines 1-2, replace the phrase "...A computer-readable recording medium on which a program enabling the method of claim 1 is recorded..." with "...A computer-readable recording medium encoded with a computer program having instructions for processing the method of claim 1."

Claim 31, lines 1-2, replace the phrase "...A computer-readable recording medium on which a program enabling the method of claim 7 is recorded..." with "...A computer-readable recording medium encoded with a computer program having instructions for processing the method of claim 7."

Claim 32, lines 1-2, replace the phrase "...A computer-readable recording medium on which a program enabling the method of claim 23 is recorded..." with "...A computer-readable recording medium encoded with a computer program having instructions for processing the method of claim 23."

Claim 33, lines 1-2, replace the phrase "...A computer-readable recording medium on which a program enabling the method of claim 24 is recorded..." with "...A computer-readable recording medium encoded with a computer program having instructions for processing the method of claim 24."

The following is an examiner's statement of reasons for allowance:

Regarding claims 1, 2-6 and 30, cited prior art does not teach a method of encoding three-dimensional object data, which is comprised of point texture data, voxel

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data, or octree structure data, the method comprising: generating three-dimensional object data using a three-dimensional bounding volume to convert the three-dimensional object data into voxel data, wherein the voxels are differentiated based on whether they are located where objects exist or in a background; representing the voxel data by a tree structure of a predetermined depth in which nodes include attached labels indicating their respective types, the types comprising nodes having sub-nodes, nodes having all voxels located in the background, nodes having all voxels located where objects exist, and nodes at the predetermined depth having voxels located where objects exist and in the background, wherein the nodes at the predetermined depth having voxels located where objects exist and in the background do not have sub-nodes; encoding nodes of the three-dimensional object data; and generating the three-dimensional object data whose nodes are encoded into a bitstream; and transmitting the encoded bitstream to a decoder.

Further regarding claim 4, cited prior art teaches encoding detailed information bit (DIB) data of a node but does not teach encoding detailed information bit (DIB) data of an 'S' node if the node information indicates that the current node is an 'S' node and encoding DIB data of a 'P' node if the node information indicates that the current node is a 'P' node.

Regarding claims 7-17 and 31, cited prior art does not teach a method of encoding three-dimensional object data, which is comprised of point texture data, voxel data, or octree structure data, the method comprising: (a) generating three-dimensional object data having a tree structure of a predetermined depth in which nodes include

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attached labels indicating their respective types, the types comprising nodes having sub-nodes, nodes having all voxels located in a background, nodes having all voxels located where objects exist, and nodes at the predetermined depth having voxels located where objects exist and in the background, wherein the nodes at the predetermined depth having voxels located where objects exist and in the background do not have sub-nodes; (b) merging the nodes of the three-dimensional object data by referring to their labels; (c) encoding merged nodes; (d) generating the three-dimensional object data whose merged nodes are encoded into a bitstream; and (e) repeatedly carrying out steps (a) through (d) until an uppermost node of the tree structure representing the three-dimensional object data is encoded; and (f) transmitting the encoded three-dimensional object data to a decoder.

Further regarding claim 10, prior art does not teach wherein D is calculated in the following equation using a Hamming distance between an original model V and its approximation \hat{V} as distortion measurement:

$$D = \sum_{x=1}^X \sum_{y=1}^Y \sum_{z=1}^Z |V(x, y, z) - \hat{V}(x, y, z)|$$

, where XxYxZ represents the resolution of the original model.

Regarding claim 11 and 20, prior art does not teach encoding node type information which indicates whether or not a current node is an 'S' node or a 'P' node; and encoding DIB data of an 'S' node if the node information indicates that the current

node is an 'S' node and encoding DIB data of a 'P' node if the node information indicates that the current node is a 'P' node.

Regarding claims 18-22, cited prior art does not teach an apparatus for encoding three-dimensional object data, which is comprised of point texture data, voxel data, or octree structure data, the apparatus comprising: a tree structure generator which generates three-dimensional object data having a tree structure of a predetermined depth in which nodes include attached labels indicating their respective types, the types comprising nodes having sub-nodes, nodes having all voxels located in a background, nodes having all voxels located where objects exist, and nodes at the predetermined depth having voxels located where objects exist and in the background, wherein the nodes at the predetermined depth having voxels located where objects exist and in the background do not have sub-nodes; a merging order selector which merges the nodes of the three-dimensional object data by referring to their labels; a node encoder which encodes merged nodes; and a bitstream generator which generates the three-dimensional object data whose merged nodes are encoded into a bitstream.

Further regarding claims 9 and 19, cited prior art does not teach selecting, from among the candidate nodes as an optimal node, a node which can minimize a ratio of a difference ΔD between the number of distorted bits before in the candidate nodes and the number of distorted bits after merging the candidate nodes with respect to a difference ΔR between the number of bits before merging the candidate bits and the number of bits after merging the candidate bits; labeling the selected node 'B'; and updating all the candidate nodes except the node selected as an optimal node.

Further regarding claims 11-15 and 20, prior art does not teach encoding node type information which indicates whether or not a current node is an 'S' node or a 'P' node; and encoding DIB data of an 'S' node if the node information indicates that the current node is an 'S' node and encoding DIB data of a 'P' node if the node information indicates that the current node is a 'P' node.

Regarding claims 23 and 32, cited prior art does not teach a method of decoding three-dimensional object data, comprising: reading continue flag information from a bitstream of encoded three-dimensional object data and decoding the continue flag information; decoding node type information of the bitstream, comprising: decoding an 'S' node if the node type information indicates that a current node is a node having sub-nodes, and decoding a 'P' node if the node type information indicates that the current node is a node at a predetermined depth of a tree structure having voxels located where objects exist and in a background and that the current node does not have sub-nodes; restoring the three-dimensional object data whose nodes are encoded to the tree structure; and displaying the decoded three-dimensional object data.

Regarding claims 24-29 and 33, cited prior art does not teach a method of decoding three-dimensional object data, comprising: decoding nodes of a bitstream of encoded three-dimensional object data, comprising decoding node type information of the bitstream, wherein the node type information describes nodes having sub-nodes and nodes at a predetermined depth of a tree structure having voxels located where objects exist and in a background, wherein the nodes at the predetermined depth of the tree structure having voxels located where objects exist and in the background do not

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have sub-nodes; restoring the three-dimensional object data whose nodes are encoded to the tree structure; and displaying the decoded three-dimensional object data.

Further regarding claim 26, cited prior art does not teach wherein in decoding the 'S' node, an average color of eight sub-nodes of the current node is decoded as DIB data, and the eight sub-nodes are sequentially decoded into black nodes ('B' nodes) or white nodes ('W' nodes).

Further regarding claim 27, prior art does not teach wherein in decoding the PPM node, the current node is PPM-decoded using DIB data bits (DIB) data, and R, G, and B values of 'B' voxels of the current node are decoded by carrying out inverse AAC and inverse DPCM.

Further regarding claim 29, prior art does not teach an 'S' node decoder which decodes an average color of eight sub-nodes of the current node as DIB data and then sequentially decodes the eight sub-nodes into 'B' nodes or 'W' nodes; and a 'P' node decoder which PPM-decodes DIB data of the current node and then decodes R, G, and B values of 'B' voxels of the current node by carrying out inverse AAC and inverse DPCM decoding an 'S' node, if the node type information indicates that a current node is a PPM node.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

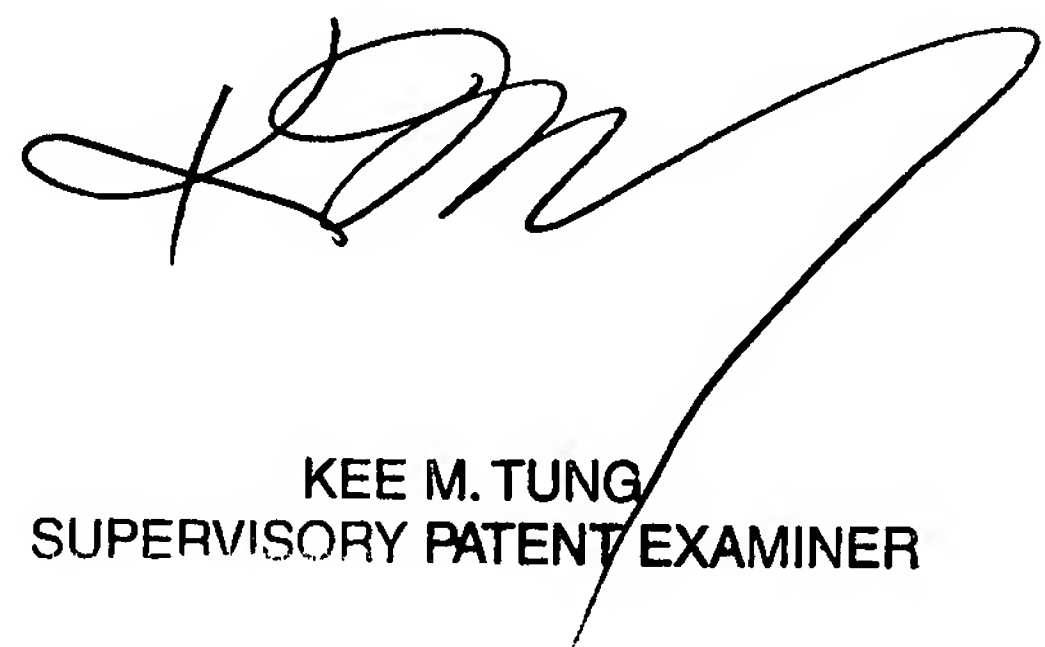
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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Roberta Prendergast whose telephone number is (571) 272-7647. The examiner can normally be reached on M-F 7:00-4:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ulka Chauhan can be reached on (571) 272-7782. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

RP 3/29/2007



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